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WEEVILS WHICH MAY ATTACK THE BASES AND ROOTS OF CONIFERS IN THE LAKE STATES, AND METHODS OF PREVENTING INJURY

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Coniferous seedlings, transplants, and sapling trees are often killed or severely injured by girdling caused by the feeding activity of certain weevils. At least six species are found in the Lake States Region (Michigan, Wisconsin, and Minnesota), and although not all these are considered important, at the present time they offer a potential serious hazard to the recently established nurseries and extensive acreages of plantations in the region. Some of the species may kill large quantities of vigorous, healthy nursery stock; others may kill young natural growth and plantation trees, or attack and ultimately cause the death of young saplings or trees which have been weakened by some other agency. The field distinguishing characters, life history, and habits of each of the six species are discussed herein, and possible control measures or methods of preventing injury are suggested.

The strawberry root weevil (Brachyrhinus ovatus (L.)) and the black vine weevil (B. sulcatus (F.)) are, as their names imply, important pests of strawberry plants and vines. However, at times they have been reported as doing damage in forest and ornamental tree nurseries in New England, New York, Pennsylvania, and Michigan. They attack a variety of hosts, among which are hemlock, various pines, spruces, yew, and the horticultural varieties of arborvitae and juniper. Occasionally the adults feed on needles and twigs of hemlocks, cedars, etc., but the injury of most importance, in all the hosts, is that done by the larvae. The bark is eaten from the main stem and roots from the surface of the ground to a depth of several inches. In some cases all the seedlings in seedbeds have been killed, and the injury to transplants has been severe.

The larvae of these two species are footless and are grayish white in color, those of Brachyrhinus ovatus having yellow heads and those of B. sulcatus having brown heads. The mature larval and adult

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stages of B. ovatus are about 5 mm. long, and those of B. sulcatus are about 10 mm. long. Superficially the adults are very similar, except in size. They are brownish black, and, in common with most weevils, have a pronounced beak which is somewhat broadened and notched at the tip. The thorax of B. sulcatus is covered with round tubercles, each bearing a short hair, whereas that of B. ovatus has longitudinal ridges. Tufts of buff or cream-colored hairs are present on the elytra of B. sulcatus and are lacking on B. ovatus. In both species the sulcate elytra, or forewings, are at least partially grown together; they have no hind wings, and flight therefore is impossible.

Hibernation, in most cases, takes place in the larval stage at depths of from 6 to 14 inches below the surface of the ground. Pupation begins late in May or early in June, and the adults emerge in June and the first part of July over a period of more than a month. The eggs, which are white, are laid on the foliage or in the ground near the roots of host plants throughout July and August and hatch in from 1 to 2 weeks. The larvae feed to some extent before they go into hibernation, but the serious injury is caused the following spring, as they work toward the surface, feeding on the roots as they move upward. Under the most favorable conditions, larvae from eggs laid early in the season may complete their development and become adults before cold weather, and in such cases hibernation takes place under stones or debris beneath the trees.

Control of these insects in the soil of infested seedbeds by using soil poisons or fumigants has not proved satisfactory because a concentration that will kill the larvae is usually toxic to the plants. In large infested nurseries the most practical method of preventing injury to transplants large enough for planting is to remove them prior to the time the larvae resume activity (just after the ground is free of frost) and place the stock in cold storage until the time for planting.

The adults of both species, being wingless, migrate and reach places for oviposition chiefly by crawling. Access to seedbeds can therefore be prevented by smearing the sides of the "bed-boards" with a sticky tree-banding material. If it is necessary to prevent egg laying in these beds the second season, the boards can be placed in position and smeared when the adults become active. Experiments in controlling the adults by poisoned baits have been carried on in various parts of the country. A bait made of 95 pounds of dried-apple waste and 5 pounds of powdered calcium arsenate, spread on the ground at the rate of 50 to 70 pounds per acre at the time the weevils are migrating, has proved effective.1/ In New York two baits which gave almost complete control were made of the following materials: (1) 50 pounds of

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1/ McDaniel, E. I. Some Chewing Insects Infesting Michigan Evergreens. Mich. Agr. Expt. Sta. Cir. Bul. 141, 52 pp., illus. 1932.

raisins, 50 pounds of shorts, and 5 pounds of sodium fluosilicate; (2) 100 pounds of bran, 2 gallons of molasses, 8 gallons of water, and 5 pounds of sodium fluosilicate. 2/ Similar baits with lead arsenate or calcium arsenate as the poison were also used with success. Transplant beds in infested areas should be fumigated with full-strength carbon disulfide before the plants are set. To allow for complete volatilizition, it is suggested that fumigation be done early in the fall before the ground is frozen, as volatilization in a cold, wet spring might be so slow that the insects would not be killed. Clean cultivation and the rotation of seed and transplant beds, allowing infested areas to lie fallow and be thoroughly cultivated and fumigated in alternate years, provide the most satisfactory and logical control measures.

The pales weevil (Hylobius pales (Herbst)) is a moderately robust weevil, dark reddish brown to black, 7 to 10 mm. in length, marked irregularly and somewhat sparsely on both the thorax and elytra with gray or yellowish hairs. The beak is rather stout, and the antennae are inserted well in front of the middle. This weevil is found from Nova Scotia to Florida and west to the Lake States. Northern white pine is the favored host, and red pine is commonly attacked. Other conifers, in both planted and natural growth within the range of the insect, are also susceptible.

The beetles pass the winter in the litter, becoming active, depending on locality and altitude, from April to June. During this time, which is a flight period, they are attracted to cut-over areas by the pine odor, and they feed on the tender bark of the twigs of saplings and at the base of seedlings. The eggs, which are pearly white, are laid singly during the latter half of June and the first part of July in the inner bark of freshly cut pine logs and large pieces of slash or in that of the base and large roots of freshly cut pine stumps. They hatch in about 2 weeks, and the larvae develop under the bark in this material; they cannot develop in healthy trees. They are white and footless and, when full-grown, are slightly longer than the adult weevils. Pupal cells are formed in the surface of the wood and are covered with shredded wood fibers; these cells are often called "chip cocoons." The young adults emerge during the latter half of August and in September. It is at this time that the severe damage occurs to young seedlings and transplants which may be in the cut-over area. The beetles gnaw away the bark on the stems or branches of the trees. This injury results in the withering of the young trees, and it is then too late for control measures. Most of the feeding is done at night, but some may occur in the daytime below the surface of the litter where the light intensity is not great.

2/ Gambrell, F. L. The Strawberry Root Weevil as a Pest of Conifers in Nursery Plantings. Jour. Econ. Ent. 31 (1): 107-113. 1938.

This is a very serious pest in cut-over pine lands, often causing mortality of almost all the seedlings unless there are several thousand to the acre. 3/ The Harvard Forest, in Massachusetts, recommends cutting in a seed year, or thinning before the cutting in order to stimulate an overabundance of pine reproduction. To prevent attack on cut-over areas where planting is necessary to insure adequate stocking, it is advisable to postpone planting until the third growing season after the cutting operation. 4/ By this time the stumps and larger pieces of slash will have seasoned and will not be suitable for oviposition. This is standard practice in some parts of New England. Freshly sawed pine lumber should not be piled near young natural stands or plantations, as the pine odor will attract the weevils, which are strong fliers, from a considerable distance, and much damage may be caused by their feeding before it is noticed.

The pine root-collar weevil, or Scotch pine weevil as it is sometimes called (Hylobius radicis Buch.), is a recently described species which has been found attacking Scotch, red, jack, Austrian, or Corsican pines in Michigan, Minnesota, Connecticut, Massachusetts, New York, and Pennsylvania. For some time it was confused with the pales weevil, as the two species resemble each other so closely that a superficial examination will not suffice to separate them. 5/ Their habits, however, make it possible to identify them readily in the field. Hibernation may take place in the larval and adult stages. Those adults that hibernate resume activity early in the spring, like the pales weevil. They feed at night on the tender bark of pine twigs. The larvae that have hibernated pupate and emerge in July and August. The eggs are laid in the soil near the base of the trees, oviposition continuing throughout the summer. Unlike the pales weevil, the larvae, rather than the adults, cause the serious injury, and large as well as small trees are attacked. The feeding of the larvae is confined to the inner bark and cambium of the root-collar region. Tunnels are usually extended out into the soil around the base of the attacked trees, evidently in an effort to dispose of the copious flow of pitch. During the latter part of the season larvae, pupae, and adults may be found in the burrows, and when they are numerous the tree may be entirely girdled. Pupation occurs in the tunnels in the resin-saturated soil or in enlarged cells in the bark of infested trees, but the pupal cells are not lined with shredded wood fibers such as are

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3/ Peirson, H. B. The Life History and Control of the Pales Weevil (Hylobius pales). Harvard Forest Bul. No. 3, 33 pp. 1921.

4/ Carter, E. E. Hylobius pales as a Factor in the Reproduction of Conifers in New England. Soc. Amer. Foresters Proc. 11 (3): 297-307. 1916.

5/ York, H. H. Some Observations on Hylobius pales Herbst. Jour. Econ. Ent. 26 (1): 218-221. 1933.

characteristic of the pupal cells of the pales weevil. Adults that emerge late in the summer hibernate in the duff or litter under the trees.

Control of the pine root-collar weevil is difficult, although in certain instances local applications of sodium cyanide or carbon disulfide have proved partially successful. 6/ In New York a water solution of 1 ounce of powdered sodium cyanide to 1 gallon of water was effective. The amount necessary for a tree depends on its size; a 2- to 4-inch tree, for example, will need 1 pint poured around the base. Carbon disulfide should be used full strength at the rate of 1/2 cupful per 2- to 4-inch tree. These materials will kill the root systems of small trees if they come in contact with them at the time of application, but this mortality is not likely to occur when the ground around the root collar of large saplings or trees is treated. Each of these materials must be used with great care; the sodium cyanide forms a poisonous gas that is toxic to human beings; and the carbon disulfide forms a gas that is highly inflammable when mixed with air.

Two other species of weevils, Pissodes approximatus Hopk. and Hypomolyx piceus (Deg.), may be found in trees attacked by the pine root-collar weevil or working by themselves. In both the full-grown larval and adult stages they can readily be distinguished from one another by their size and color. P. approximatus averages about 6 mm. in length and is usually light brown; H. piceus averages about 13 mm. and is black; the pine root-collar weevil averages about 10½ mm. in length and is dark reddish brown. Young trees or saplings that have been weakened by some other agency are most susceptible to attack by P. approximatus. The larvae are always found between the inner bark and the wood and usually in the lower part of the tree trunk but above the root-collar region. Their pupal chambers, lined with coarse frass, are entirely in the wood. Control measures are not necessary, since the trees are in a dying condition before being attacked. The habits of H. piceus, in all stages, are very similar to those of the pine root-collar weevil, and similar control measures can be used.

6/ New York State Conservation Department, Twenty-third Annual Report (1933), 426 pp. 1934. "Scotch Pine Weevil," p. 107.

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